MODERN UPLIFT OF THE TRANSANTARCTIC MOUNTAINS: PRELIMINARY RESULTS OF AN AUTONOMOUS GPS ARRAY

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An autonomous GPS array is being implemented in the Transantarctic Mountains, sponsored by NSF and NASA, for the purpose of measuring uplift resulting from post-glacial rebound (PGR). The rebound of the solid earth due to unloading of ice since the Last Glacial Maximum is expected to dominate the measured uplift for most of West Antarctica, dwarfing the signals due to present-day ice sheet mass balance changes and tectonic motion, as long as mantle viscosity is greater than about 10^{20} Pa-s. Predicted uplift patterns have been calculated for a range of model scenarios (James and Ivins 1998), which illustrate how the uplift pattern might distinguish between different-sized ice sheets and deglaciation histories as represented by the competing models. The scenarios considered by James and Ivins (1998) include ICE-3G (Tushingham and Peltier 1991), ICE-4G (Peltier 1994), CLIMAP (Hughes et al. 1981; Stuiver et al. 1981; Clark and Lingle 1979) and a variation of the CLIMAP model by Denton et al. (1991; herein called D91). For these models, peak uplift rates occur in the Transantarctic Mountains, and differences between models is often large there. Thus, the Transantarctic Mountains are an ideal place to obtain uplift measurements to constrain deglaciation models.

Geodetic methods are used to measure uplift to sub-cm accuracy in the horizontal components (North and East), and less than 2 cm in the vertical. We are most interested in the vertical rate, which can be measured by GPS to an accuracy of a few mm/yr within five years of continuous or quasi-continuous measurements. Two sites have been established thus far, one in the Dry Valleys at Mt. Coates (12/96) and one in the Royal Society Range at Mt. Cocks (1/98), forming a 3-station network with the permanent tracker at McMurdo station. Data have only been obtained during the austral summers; this is the third season for Mt. Coates and the second at Mt. Cocks. The stations are powered by a hybrid solar/wind generator system, and employ wireless line-of-sight RF modems to transmit data back to McMurdo for transfer to JPL. Instrumentation includes a high precision TurboRogue GPS receiver, R. M. Young wind monitor, platinum resistance thermistor for temperature measurements, and a system microcontroller that monitors environmental parameters, controls the system thermal environment, and reports data through the modem.

Several permanent GPS sites exist on the continent. These stations (McMurdo, Palmer, O'Higgins, Syowa, Davis, Casey and Mawson) constitute a reference network tying the Antarctic continent to an absolute global reference frame. The measurements made at Mt. Coates and Mt. Cocks can be compared to these sites to improve the accuracy of the vertical rate determination by eliminating common mode errors. The preliminary, up-to-date data series from Mt. Coates and Mt. Cocks will be discussed in relation to the other permanent Antarctic sites. Thus far, the data from Mt. Coates agree well with the McMurdo data series, and show no significant uplift signal. There are significant horizontal residuals with respect to the NUVEL-1 No-Net-Rotation (NNR) model, which are systematic amongst most of the permanent stations, and likely reflect glacial isostasy.

The Transantarctic GPS array will be expanded to up to eight stations spanning the length of the range. In addition, sites in Marie Byrd Land installed this season by B. Luyendyk and A. Donnellan form baselines with the existing and future Transantarctic sites that cross the West Antarctic Rift System, enabling rates of motion across the rift to be resolved. The array will provide critical independent constraints on post-glacial rebound models which in turn will improve the estimate of present-day ice mass balance from the Gravity Recovery and Atmospheric Change Experiment (GRACE) dual satellite-to-satellite tracking gravity mission and repeated measurements of the topography of the ice sheet to be made using the Geoscience Laser Altimeter System (GLAS) by the ICEsat mission. Both of these missions will launch in the year 2001.

References. Denton, G.H., M.L. Prentice,L.H. Burckle, 1991, in *Geology of Antarctica*, R. J. Tingey, ed., pp. 365-433, Oxford Univ. Press, New York; Hughes, T.J., G.H. Denton, B.G. Anderson, D.H. Schilling, J.L. Fastook,C. S. Lingle, 1981, in *The Last Great Ice Sheets*, G.H. Denton, T.J.Hughes, eds., pp. 263-317, John Wiley, New York; James, T. S., E.R. Ivins, 1998, **J. Geophys. Res., 103,** 4993-5017; Lingle, C.S., J.A. Clark, 1979, **J. Glaciology, 24,** 213-230; Peltier, W.R., 1994, **Science, 265,** 195-201; Stuiver, M., G.H. Denton, T.J.Hughes, J.L.Fastook, 1981, in *The Last Great Ice Sheets*, G.H. Denton, T.J.Hughes, eds., pp. 319-436; Tushingham, A. M., and W. R. Peltier, 1991, **J. Geophys. Res., 96,** 4497-4523.